

REMARKS

Claim 16 has been amended to recite "wherein said second fluid channels lie generally in a plane" and "wherein the direction of flow of said first fluid channels is generally perpendicular to the [direction of flow] plane of said second fluid channels." Basis for this amendment may be found, for example, in the specification at page 7, lines 1 - 4, page 21, lines 2-6; Figures 1, 10, and 12; and Claim 1 as originally filed.

In compliance with M.P.E.P. § 608.01, the citation for a hyperlink to an Internet page has been deleted from the specification at page 4, but the citation should appear on the first page of the issued patent under the heading "Other Publications." In addition, a printed copy of this reference is located in the file history of the priority application, S.N. 09/501,215, filed February 9, 2000, now U.S. Patent No. 6,415,860.

In accordance with 37 C.F.R. § 1.121, a marked-up version of the Claims is presented in Appendix A, and a marked of version of the Specification is presented in Appendix B.

Reexamination and reconsideration of the application, as amended, are respectfully requested.

The Incorporations by Reference

The Office objected to the incorporation of certain materials by reference. The specification is believed to be, and was intended to be, fully enabling to one of ordinary skill in the art -- even without the incorporations by reference. The reason that various references were incorporated into the specification by reference was to avoid the

inadvertent omission of some disclosure later deemed (in hindsight) to have been essential to support the claims under 35 U.S.C. § 112, first paragraph. If an inadvertent omission of essential material had been made, the omitted essential material could then be added by amendment.

See M.P.E.P. § 608.01(p)(I)(B), which expressly allows incorporation by reference of virtually any patent, patent application, or non-patent publication, unless the incorporated material is "essential."

The Office has not identified any omitted material that it considers to be "essential." If the Office believes that any essential material has been omitted, the Office is respectfully requested to identify that material. Otherwise, the incorporations by reference are respectfully submitted to be proper. See M.P.E.P. § 608.01(p)(I)(A).

Same Invention-Type Double Patenting Rejection

Claims 1-7 and 12-15 were rejected under the doctrine of statutory-type double patenting as claiming the same invention as that of claims 1-7 and 12-15 of prior United States Patent No. 6,415,860.

Claims 1-7 and 12-15 have been canceled. In light of these amendments, Applicants respectfully submit that this rejection should be withdrawn.

The Obviousness-Type Double Patenting Rejection

Claims 16-21 and 25 were rejected under the doctrine of obviousness-type double patenting as being unpatentable over claims 1-6 and 12 of United States Patent No. 6,415,860. Claims 35 and 36 were also rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 12 of U.S. Patent No. 6,415,860 in view of Hoopman et al. Claim 35 has been canceled. A Terminal Disclaimer was submitted with this application on October 25, 2001. The terminal disclaimer overcomes any obviousness-type double-patenting rejection based on the '860 patent. Applicants respectfully submit that this rejection should be withdrawn.

Th § 102(b) and 103(a) Rejections

Claims 16-21, 25, 35, and 36.

Claims 16-21 and 25 were rejected under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, as being obvious over Schubert *et al.* (U.S. Pat. No. 5,803,600), in some cases, in combination with a secondary reference. The Office cited Schubert as teaching "a heat exchanger with micro channels arranged in crossflow (11, 12, Fig. 3a, 3b). The dimensions of the channels (100 microns wide, 70 microns deep), separated by webs 15 microns wide, result in a channel density well above the claimed minimum of 50 per square centimeter. Note that the layers of channels are interleaved. As for the claimed heat exchanger thickness, given that the illustrative embodiments of Figs. 3a and 3b show at most 8 layers, and the layer thickness of the foils given is 100 microns, this limitation of claim 16 is also considered to be clearly met by Schubert et al." pg. 5, December 22, 2003 Office Action.

MPEP § 2131 states, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. The identical invention must be shown in as complete detail as is contained in the ... claim. The elements must be arranged as required by the claim." (Citations Omitted)

Claim 16 has been amended to recite "wherein said second fluid channels lie generally in a plane and "wherein the direction of flow of said first fluid channels is generally perpendicular to the [direction of flow] plane of said second fluid channels." Applicants respectfully submit that the claimed invention, as amended, is both novel and

nonobvious over the cited reference. Schubert neither teaches nor suggests the cross flow configuration described in amended Claim 16. In particular, Schubert neither teaches nor suggests a heat exchanger having the following properties required by independent Claim 16:

"one or more second, multiply interconnected fluid channels through which the second fluid may flow,"

and

"wherein said second fluid channels lie generally in a plane;"

and

"wherein said first fluid channels and said second fluid channels interleave,"

and

" wherein the direction of flow of said first fluid channels is generally perpendicular to the plane of said second fluid channels."

The claimed invention is distinguishable from the device disclosed in the Schubert patent. Schubert discloses a device for rapidly mixing fluids by dividing the fluids into separate flow channels using a flow guide structure in which the first and second fluids flow generally in the same plane, or in parallel planes. See Col. 1, line 64 through Col. 2, line 14; and Figs. 1a and 1b. Schubert teaches a multilayered static micromixer for mixing at least two fluids comprising a flow guide structure having foils disposed on top of each other and having parallel grooves that extend along a longitudinal axis in the flow direction of the fluids, and a mixing chamber located at the end of the flow guide structure. A heat exchanger may also be added to the micromixer to allow for heat transfer between the fluid

mixture and fluid contained in the heat exchanger. See Col. 1, line 64 through Col. 2, line 2; and Col. 2, lines 25-31. According to Schubert:

"The foils 1 includes a series of preferably parallel closely adjacent grooves 4 extending at an angle to the longitudinal mixer axis 3. The grooves 4 start at the left back (entrance end) and have an acute angle $+\alpha$ with respect to the axis 3. They end in the center area at the front (exit end) of the foil longitudinal side. The foils 2 are provide in the same manner with grooves 5 which are however arranged at an angle of $-\alpha$ with respect to the longitudinal axis of the mixer (in general flow direction) and which starts at the back right side (entrance end) and extend to the front center area (exit end) of the foils 2." Column 2, lines 56-66.

The claimed invention, by contrast, is a crossflow heat exchanger for achieving heat transfer between a first fluid flowing through fluid channels and a second fluid flowing through one or more multiply interconnected passages, or a single, multiply interconnected passage, interconnected (i.e., interspersed) within in the same plane. See Figs. 10 and 12. The novel device comprises first fluid channels through which a first fluid may flow, and "one or more second, multiply interconnected fluid channels through which a second fluid may flow; wherein said first fluid channels and said second fluid channels interleave, so that heat may be transferred between said first fluid channels and said second fluid channels; wherein the direction of flow of said first fluid channels is generally perpendicular to the plane of said second fluid channels." Claim 16, as amended; see also Figs. 10 and 12.

Schubert neither teaches nor suggests the claimed invention, a heat exchanger having "multiply interconnected fluid channels through which a second fluid may flow; wherein "said second fluid channels lie generally in a plane;" "said first fluid channels and said second fluid channels interleave;" and that has first fluid channels with a direction of

fluid flow "generally perpendicular to the plane of said second fluid channels." In fact, Schubert teaches away from the current invention by requiring the use of a flow guide structure having separate flow channels in which the first and second fluids flow generally in the same plane, or in parallel planes.

A further indication that Schubert teaches away from the current invention is seen in Schubert's Figs. 2a and 2b. As illustrated in Figs. 2a and 2b, the device achieves heat transfer by using intermediate foils **10** with grooves **10a** between foil plates **1** and **2**. See Col. 3, lines 32-37. To remove or add heat to the fluid flowing through foil plates **1** and **2**, a third fluid is flowed through grooves **10a** in a plane parallel to the planes for fluid flow through foil plates **1** and **2**. See, e.g., Figs. 1c, 2b, and 3b; and Col. 3, lines 53-56. In addition, the fluid channels within foil plates **1** or **2** are not interconnected, but instead are separated by intermediate webs **4a** and **5a**, respectively.

By contrast, in the claimed invention, the second fluid channels, as shown in Figs. 10 and 12, are multiply interconnected and lie generally in a plane. To transfer heat transfer between the first fluid channels and the second fluid channels, the fluid flowing through the first fluid channels is generally perpendicular to the plane of the second fluid channels. See Figs. 10 and 12; and Claim 16, as amended.

The Office Has Not Shown That There Would Have Been Any Motivation to Modify the Schubert Reference as Proposed. For That Reason Alone, the § 103 Rejection Should Be Withdrawn.

The Office has given no suggestion of any kind why a person of ordinary skill in the art would have found any motivation to make the proposed modifications to Schubert. In the absence of any motivation to make the proposed modifications, the Claims may not be rejected under § 103.

M.P.E.P. § 2143.01 states, "The prior art must suggest the desirability of the claimed invention. . . . Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. . . . The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." (citations and emphasis omitted)

Even Assuming That Some Motivation Had Existed to Modify Schubert, the Modification Would Not Have Resulted in the Claimed Invention.

Even assuming for the sake of argument that some motivation had existed to modify Schubert (and there was none), it would nevertheless be the case that the proposed modification (e.g., providing as few or as many layers as necessary to handle the desired

flow capacity) would not have resulted in the claimed invention. The mere selection of various parameters, including thickness to handle the desired flow capacity for a given application, would not have produced a heat exchanger having "multiply interconnected fluid channels through which a second fluid may flow; wherein "said second fluid channels lie generally in a plane;" "said first fluid channels and said second fluid channels interleave;" and that has first fluid channels with a direction of fluid flow "generally perpendicular to the plane of said second fluid channels."

§§ 102 and 103 Summary

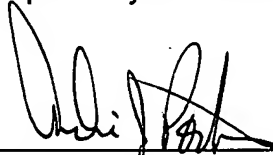
The 35 U.S.C. §§ 102 and 103 rejections should be withdrawn, for any one of several different reasons. Schubert, the primary reference cited by the Office, does not contain each and every element as set forth in the claimed invention. In addition, the Office has not shown that there would have been any motivation to make the proposed modification of Schubert. Furthermore, the teachings of the cited reference are sufficiently diverse, and the goals of the cited reference sufficiently different, that a person of ordinary skill in the art would not have had any motivation to make the proposed modification. Even assuming for the sake of argument that such a motivation had existed, the proposed modification still would not have resulted in the claimed invention.

Claim 35 has been canceled. Claims 17-21, 25, and 36 are dependent from Claim 16. Therefore, if Claim 16 is allowed, it is respectfully submitted that Claims 17-21, 25, and 36 should also be allowed.

Conclusion

For the reasons given, it is respectfully submitted that all pending Claims are in condition for allowance. If the Office disagrees with any of these remarks, or if other issues arise that may present an obstacle to allowance, the undersigned would welcome a telephone call to discuss such matters before further action is taken. Otherwise, allowance of Claims 16-21, 25, and 36 at an early date is solicited.

Respectfully submitted,



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Appendix A: Complete Listing of Claims

We claim:

Claims 1-15 (canceled)

Claim 16 (currently amended): A heat exchanger for transferring heat between a first fluid and a second fluid; wherein said heat exchanger comprises first fluid channels through which the first fluid may flow, and one or more second, multiply interconnected fluid channels through which the second fluid may flow, wherein said second fluid channels lie generally in a plane; wherein said first fluid channels and said second fluid channels interleave, so that heat may be transferred between said first fluid channels and said second fluid channels; wherein the direction of flow of said first fluid channels is generally perpendicular to the direction of flow of said second fluid channels; wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 6.0 mm; and wherein said heat exchanger has a density of said first fluid channels greater than about 50 per square centimeter.

Claim 17 (original): A heat exchanger as recited in Claim **16**, wherein said first fluid channels are adapted for the flow of a gas, and wherein said second fluid channels are adapted for the flow of a liquid.

Claim 18 (original): A heat exchanger as recited in Claim **16**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 2.0 mm.

Claim 19 (original): A heat exchanger as recited in Claim **16**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 1.0 mm.

Claim 20 (original): A heat exchanger as recited in Claim **16**, wherein said heat exchanger has a density of said first fluid channels greater than about 200 per square centimeter.

Claim 21 (original): A heat exchanger as recited in Claim **16**, wherein the thickness of said heat exchanger, in the direction of flow of said first fluid channels, is less than about 1.0 mm; and wherein said heat exchanger has a density of said first fluid channels greater than about 200 per square centimeter.

Claims 22-24 (Canceled)

Claim 25 (original): A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from metal.

Claims 26-35 (canceled)

Claim 36 (previously presented): A heat exchanger as recited in Claim **16**, wherein said heat exchanger is fabricated from nickel.

Appendix B: Amendment to Specification

Please amend the paragraph appearing on page 4, lines 3-6 as follows:

The Internet page "Micro Heat Exchangers" <http://www.imm-mainz.de/english/developm/products/exchange.html> (1998) depicts a miniaturized plate heat exchanger consisting of several layers of microstructured plates, intended for the countercurrent flow of fluids (presumably, liquids) in the different layers.